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31 MAY. 1920

YORKSHIRE PHILOSOPHICAL SOCIETY.



ANNUAL REPORT

FOR

MCMXIX.

ANNUAL REPORT
OF THE COUNCIL
OF THE
YORKSHIRE
PHILOSOPHICAL SOCIETY

FOR
MCMXIX.



PRESENTED TO THE ANNUAL MEETING,

FEBRUARY 9th, 1920.

YORK:
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1920.

TRUSTEES
OF
THE YORKSHIRE MUSEUM,
APPOINTED BY ROYAL GRANT,

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LORD DERAMORE.

CHAS. E. ELMHIRST.

SIR GEORGE GIBB, LL.B.

EDWIN GRAY, LL.M.

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OF THE
Yorkshire Philosophical Society.

HIS MAJESTY THE KING.

HER MAJESTY THE QUEEN.

QUEEN ALEXANDRA.

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SUB-CURATOR : W. WATSON.

REPORT OF THE COUNCIL
OF THE
YORKSHIRE PHILOSOPHICAL SOCIETY,
FEBRUARY 9TH, 1920.

THE past year has been a successful one for the Society. Our membership has increased from 482 to 515, the highest figure it has ever reached.

The Gardens were thrown open to the public on the 19th July last when Peace was officially celebrated throughout the country. In the evening the grounds and St. Mary's Abbey were illuminated most effectively, but unfortunately the night turned out very wet.

During the whole of the year 1919 your Council have been deprived of the services of Mr. Oxley Grabham. An attack of influenza was followed by a nervous breakdown, from which, your Council regret to say, that in spite of complete change and rest, he has not yet recovered and his resignation has been reluctantly accepted. Mr. Grabham became Keeper of the Museum in 1905. He came to us with the reputation of a keen and capable naturalist, and for fourteen years he has been associated with the work of the Museum. Not only has he delighted our members with his natural history lectures illustrated by unrivalled slides of his own taking, but he has materially enriched the Collection by presenting his own valuable specimens of birds and mammals. His series of the varieties of the mole are particularly good. He had a wide acquaintance in the County and secured the support of many

It is urgently requested that any discovery of Archæological interest in the neighbourhood may be brought to the notice of either the Chairman, Honorary Curators, or the Keeper of the Museum as early as possible.

The Keeper of the Museum will be pleased to give any information in his power, and may be seen daily, Museum engagements permitting.

Postcards of many of the most important antiquities may be obtained in the Museum at Two Pence each.



country gentlemen for the Museum who in consequence took an interest in the Society and added to our Collections. His knowledge of Yorkshire pottery was considerable, and his paper on the subject enriched our Report for 1915.

Owing to the death of Mr. C. Wakefield, his Collection of Coins came into the market. These included nearly half of the well-known Bishophill "find" of 1881, the other half being already in the possession of our Society, and consisted of 162 pennies and half-pennies of Edward the Confessor, all in good condition; also some 140 coins of the Bootham "find" of 1896, consisting principally of pennies of the York and Durham mints of Edward IV., but they also included valuable specimens of a Restoration penny of Henry VI., and a half-groat of Edward IV., London mint (contemporary forgery). Both of these lots were purchased by our Society. Mr. Wakefield owned a complete set of sovereigns and half-sovereigns of every year of the reign of Queen Victoria, almost all in mint condition, and from these we were able to improve our own Collection, many of which were somewhat worn specimens, and we effected numerous exchanges of gold, silver and copper modern coins without cost, as only the face value could be charged.

In October last negotiations were opened for acquiring the well-known Collection of Antiquities known as "The Mitchelson Museum" at Pickering, and these were brought to a satisfactory issue. The Collection is now in our Museum and will, we hope, soon be exhibited in the Ethnological Room. These specimens form a very important addition to our already considerable series of ancient British remains. They include some 150 sepulchral and other urns taken from tumuli on the Wolds and the hills round Pickering, principally by the late Mr. Kendall between the years 1850 and 1860. 110 stone hammers and over 300 flint arrow heads. There is a fine slab tomb enclosing a complete skeleton found at Spaunton, near Lastingham, and a pair of chariot wheels from near Cawthorne camp, 15 stone querns or hand mills, and 10 boxes of remains from the Lake Dwellings on the banks of the River Costa which have not yet been carefully examined. The principal value of this Collection consists in the fact that it is all

“Yorkshire,” and was found in and around the Vale of Pickering, and as such it is most fitting that it should find a home in the Museum of the County Society.

A golden eagle has been added to the Bird Gallery, presented by Major P. J. Waldron, of Pitlochry, and a very handsome pair of pheasant varieties presented by our President. Although containing a very large number of rare birds, our Collection has hitherto been singularly lacking in many of the commoner species, and some twenty of these have during the past year been purchased and will shortly be cased.

The washing, re-mounting and re-labelling of the Geological Collection, Yorkshire and general, has now been completed as well as the whole series of rock specimens. Our sub-curator, Mr. Wm. Watson, and Miss Holmes are now engaged upon the minerals which are being treated in the same way and will be completed within the next six months. Your Council would once again express their appreciation of the excellent way in which this work has been done.

Our gardener, Edward Hall, and our assistant librarian, Mr. Robertshaw, have been demobilised during the past year and both returned to their old posts which had been kept open for them, but the latter has since left us to take up similar work elsewhere. Your Council wish to express their thanks to Dr. Gayner for all the time and attention he has devoted to the Library.

Much of interest in old York has in the past been destroyed or allowed to fall into ruin, and the present-day citizen is fond of blaming our predecessors for vandalism and neglect. In last year's Report there is a paragraph referring to the fourteenth century Bedern Chapel, and that the Dean of York was interesting himself to obtain its restoration. This chapel is the last monastic chapel remaining in the city. Your Council regrets to hear that the widespread appeal of the Dean of York for funds to save and restore this chapel has, up to the present time, met with little, if any response, and they feel that it will be a lasting disgrace not only to the citizens at large, but particularly to the members of our Society and all interested in the archæological relics of the past, if this chapel is allowed to disappear. We would appeal to our members to support

a fund for this purpose, particulars of which will shortly be circulated.

The following is a full list of the Lectures delivered in the Tempest Anderson Hall during the past year :

- Thursday, January 9th.—“Man's Influence on Nature.” By Ernest Young.
 Thursday, January 23rd.—“Nature as Artist and Artisan.” By the Rev. J. Tyssul Davis,
 Thursday, February 6th.—“With the Italian Armies.” By the Rev. Hugh C. Wallace.
 Thursday, February 20th.—“The Reclamation of the Desert.” By Edward Cressey.
 Thursday, March 6th.—“The Romantic Isles of Shetland.” By the Rev. N. Paxton.
 Thursday, March 20th.—“The English Lake Country.” By H. H. Gleave.
 Thursday, October 9th.—“Animals of Long Ago.” By the Rev. Benjamin Oriel.
 Thursday, October 23rd.—“The Capture of Jerusalem.” By J. R. Ogden.
 Thursday, November 6th.—“King Solomon's Mines.” By W. A. Elliott.
 Thursday, November 20th.—“Flying and the Future of the Air.” By Major W. T. Blake, Wing Adjutant.
 Thursday, December 4th.—“Through Albania, weird and wild.” By the Rev. Hugh C. Wallace.
 Thursday, December 18th.—“Serbia.” By C. B. Howdill, A.R.I.B.A.

The Papers read at the Monthly Meetings of the Society during 1919 were as follows :

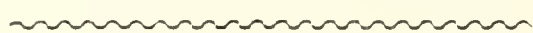
- March 10th.—“Henry Hindley, a York Clock Maker.” By John Scott.
 April 14th.—“Native Life and Scenes in West Africa.” By Sydney H. Smith.
 October 13th.—“Native Life and Scenes in West Africa.” (2nd part). By Sydney H. Smith.
 November 10th.—“The Fluctuations of the Ginkgo biloba.” By Professor T. Johnson, D.Sc., F.L.S.
 December 8th.—“The Transit Instrument: its history and use.” By John Scott.

The Society has lost by death and resignation 24 members, 16 lady subscribers and 2 associates, whilst 94 new subscribers have joined the Society.

The deaths of Mr. Thomas Boynton and Mr. Malcolm Spence removed two of our Vice-Presidents. The former had for many years been one of our Hon. Curators of Antiquities, and was instrumental in obtaining for the Society in 1898 the find near Driffeld consisting, amongst other remains, of a pair

of chariot wheels and a beautiful bronze enamelled pin. In 1916 he presented almost the whole of his fine collection of Leeds and other Yorkshire Pottery which is now exhibited in the Gallery of the Central Hall. Mr. Malcolm Spence had been a Member of the Society for over 30 years and read several papers on the early domestic life of the country, besides taking a warm and practical interest in the maintenance of the gardens and museum buildings. He was also a Vice-President of the Photographic Section.

The Council recommend that Mr. Harvey Brook, Mr. Cecil H. Cobb, the Rev. A. Raine, and Colonel W. A. White be new Members of Council in the place of those retiring by rotation, and that Lord Bolton be elected a Vice-President.



ARCHÆOLOGY.—In the Archæological and Architectural Section there is little to report for the year 1919. The chief addition to the Collection being a mediæval stone coffin found in Peter Lane on the site of the burnt-out premises of Messrs. Brown Brothers and Taylor Ltd., and very kindly presented by them to the Museum; we owe our thanks also in this matter to George Benson, A.R.I.B.A., who approached Messrs. Brown and thus obtained for the Museum a beautifully preserved example, the head rest is quite perfect—the cover alone being missing, probably owing to previous disturbance. The coffin has been placed in the cellar which encloses the fireplace of the calefactory in the basement of the Museum.

The Collection of mediæval fragments in the Architectural Museum under the Tempest Anderson Hall, suffers from a lack of artificial light, and the curators intend to approach the Council on the subject of placing more electric lights in the room, so that on dark days and other times the objects may be seen to advantage, instead of as at present, having to strike matches to see the carving, &c. The Collection is well worthy of attention, and should be seen without the apologies the curators frequently have to make to visitors that half the beauty and interest is lost for lack of light.

Once more we have to report continued and wanton damage to the leaded windows of the lower hall of the Hospitium, and

as at an early date new windows will become a necessity, the Council will be urged to take the severest measures against the offenders.

BOTANY.—The specimens in the British Collection of Plants are in good condition, but the Foreign Collection requires some attention.

I am pleased to acknowledge the receipt of a few specimens of British plants belonging to the late Mr. Charles Wakefield.

CERAMICS.—The Ceramic specimens are in good order. A few additions have been made during the year. The work of cataloguing the specimens has been commenced.

GEOLOGY.—The work of cleaning, re-mounting, and re-labelling of specimens has now been completed so far as regards rocks and fossils. The re-arrangement of the specimens has given more space for the exhibition of mineral specimens hitherto not on view. This work will now be taken in hand.

ENTOMOLOGY.—The Society, and lepidopterists in particular, are to be congratulated on the recovery this year through the energy of Mr. William Watson, of the two lost MS. works by the late Thomas Henry Allis; the diary chiefly containing the only data we possess of this fine Collection, which ranks as one of the best in the country, and the other an early list of the genera and species then known, based on the Continental lists, with notes of localities and dates of capture appended to many of the rarer species now in the cabinets. These MSS. were presented with the Collection, and were taken away from the Museum upwards of 40 years ago. They are of great aid to a clear understanding of much that is in the Collection, besides recording species new to science. The local *Pachnobia*, *Leucographa*, and *Orthosia Suspecta* being examples. *Lygris reticulata* was introduced as a British species in 1861 and described by Henry Doubleday from the specimens captured in August 1856, on the border of one of the lakes in Westmorland, by Allis.

I have to report the addition of a small Collection of British Lepidoptera contained in a cabinet of 24 drawers, presented

during the year to the Society by Miss Wright, of Rawcliffe, near Goole. It was formed chiefly about the Nun Appleton district. Unfortunately it has not had sufficient care in times past, and has consequently lost condition. I am using the specimens as material to incorporate in a much needed Type Collection. The work of arrangement is in progress, but will necessarily take some time to complete. It will doubtless be of interest, as up to the present we have possessed no Collection of British Butterflies and Moths suitable for general use.

LIBRARY.—In May, 1916, the Council decided to set up a Standing Committee for the Library, and Mr. Platnauer explaining that his military duties rendered it impossible for him to attend to the current needs of the Library, Mr. Gayner was appointed assistant curator.

On August 3rd, 1915, the Council increased the staff of the Museum by appointing an assistant librarian to maintain and extend the library catalogue, and assist in the general clerical work of the Museum. Mr. Robertshaw, who came from the Central Library, Bradford, was appointed, but left on October 29th, 1915, to enlist.

From the outset the Committee had under their consideration the very obvious fact that while the Society owned a large and very costly collection of books which was undergoing considerable yearly increase, yet the use made of the Library was in most years negligible. An examination of the Library register for the previous ten years showed an average annual issue of thirty volumes. On an average only thirteen members of the Society took books out each year. While this was recognised as being in a very large measure a necessary sequence of the objects of the founders of the Library (which was the provision of expensive scientific books, and the elucidation of the geology of Yorkshire), yet in the opinion of the Committee held in September, 1916, it was felt worth while to try to increase the usefulness of the Library by adopting an arrangement of the books according to subject as far as might be possible. This arrangement to be modified, however, by the collecting together under the same scheme of subject-classification of all local works. It was further decided to have, in

addition to the author card index, a separate subject-title index.

Work on these lines was carried on with the aid of temporary assistance until March, 1919, when the classification was so far advanced that it was possible to make a start on the re-shelving, decided on two-and-a-half years earlier, and at the same time a very thorough cleansing of the whole collection was carried out. The Yorkshire books were placed in the first three cases in the Library starting beyond the door into the Skeleton Room. The main collection commences on the shelves above those mentioned. General works and works on natural history are arranged in the Library, while works on the applied arts and history, and especially the Society's collection of books on coins and medals, are placed in the Gallery of the Council Room. The long "runs" of some of the English scientific periodicals, and of all foreign societies, which are such an important feature in our Library, were not moved from the shelves in the Students' Room on which they were placed in 1913.

In July last Mr. Robertshaw, being released from the army, resumed his work in the Museum, since when the important work of bringing the author-index into harmony with the present shelving has been rapidly pushed forward, but much remains to be done in this regard. Members desiring to borrow books will find the sheaf catalogue their surest guide.

Your Committee was glad to be able to assist in entertaining the members of the Medico-Psychological Society of Great Britain and Ireland on their visit to York by an exhibit of a selection of the Society's illustrated books, one item being the illustration of all birds figuring on the menu at the great Cawood Feast. This afforded a striking object lesson in the diminution in the British fauna since 1465.

Serial works subscribed for during the year are the under-mentioned :

Annals and Magazine of Natural History.

Connoisseur.

Geological Magazine.

Journal of the British Archæological Association.

Memoires de la Societe Palæontographical Suisse.

Monograph of the Land and Freshwater Mollusca of
the British Isles. By John W. Taylor.

Museums Journal.

Nature.

Numismatic Chronicle.

Publications of the Palæontographical Society.

„ „ Ray Society.

„ „ Surtees Society.

„ „ Thoresby Society.

„ „ Yorkshire Parish Register Society.

Spinks's Numismatic Circular.

Yorkshire Archæological Journal.

METEOROLOGY.—*Statistics of Station*: Longitude, $1^{\circ} 5' W.$; Latitude, $53^{\circ} 57' N.$; height above mean sea level, 56 feet.

The weather of 1919 was not generally favourable to agriculture. Rain fell very irregularly, the months of growth being dry, in consequence of which hay and straw were very short and light, and prices reached heights never previously known. Yet the total rainfall was above the average.

Temperature ranged in 1919 between $18^{\circ} F.$ on Feb. 10th and $83^{\circ} F.$ which was recorded on June 9th and Sept. 11th, the range of temperature being thus 65° the same as for 1918. A mean pressure of 1013.0 millibars (1000 millibars = 29.531 mercury inches) at M.S.L., corrected for diurnal variations, has been recorded in 1919, as against 1013.9 mbs. for 1918. December was lowest with 1005.9 mbs., January next with 1006.2 mbs. October was highest with 1021.5 mbs., May next with 1018.4 mbs., June with 1018.2 mbs. The extreme range of pressure was 68.7 mbs. as compared with 54.5 mbs. for 1918, and 69.8 mbs. for 1917. The highest reading of the barometer was taken on February 9th at 9 a.m., viz.: 1042.3 mbs., and the lowest on April 14th at 9 p.m., viz.: 973.6 mbs.

Rain or Snow fell to the amount of 604 mms. The heavy rainfall of the year fell in July (84 mms.), October (82 mms.), and December (78 mms.), the cumulative total for April, May, June, being only 77 mms. The rainfall for this district was thus 42 mms. below that for the previous year. The heaviest rainfall occurred on July 19th, when 32 mms. fell. The

cumulative totals since 1820 are now:—August 5326 mms., October 5283 mms., and July 4934 mms.

Observations of winds show that during 1919 we have had “strong” winds on 26 days as against 22 for 1918, and “calms” on 22 days as against 19 for 1918. The chief winds have been observed as S. (224), N. (212), W. (182), N.W. (147). We have had 56 days of “clear” sky and 139 days “overcast,” as compared with 50 days of “clear” and 114 days “overcast” for 1918. Harvest was early and quickly gathered.

There have been 5 thunderstorms and 20 fogs as compared with 18 and 21 respectively for 1918. Snow fell on 16 days as compared with 15 and 47 days for 1918 and 1917 respectively. Hailstorms occurred on 9 days.

Bright Sunshine was observed for 1201 hours as against 1174 hours for 1918, an increase of 27 hours.

MINERALOGY.—The Hon. Curator reports the Collections of rocks and minerals are in progress of being cleaned and re-labelled. A fine series of minerals collected by the late W. J. Clutton, chiefly from the mines of Cumberland, has been presented to the Society by the Hon. Secretary.

NUMISMATICS.—The Wakefield Collection of Coins was offered by sale by auction at Sotheby's in London. Mr. William Watson attended the sale and was successful in obtaining two out of the three lots for our Society. These consisted of portions of the “Bishophill” and “Bootham” finds, and the coins have been placed in the Society's cabinet. A further reference to the Wakefield Collection appears in the Report on page vii.

THE OBSERVATORY.—During the summer of 1919 the equatorial telescope and transit instrument have been repainted and thoroughly cleaned, and they are now in first-class adjustment. The shutters on the roof for the transit instrument have been renewed, this is a great improvement. A fair number of observations were taken during the year, also more members came to look through the telescope.

The mean time clock has been taken out of the Observatory and is now in the Old Lecture Theatre.

The Observatory will be open for members to see through the telescope on all lecture nights providing it is clear, and at any other time by arrangement with the curator.

ZOOLOGY.—Several additions have been made to the British Bird Collection during the year, both by gift and by purchase. The following birds have been presented: golden eagle from near Balmoral, Bohemian pheasant (variety) from near Edinburgh, and partridge (variety) from Berwick-on-Tweed (presented by Major P. J. Waldron); pheasant (variety) and sparrow hawk (presented by Dr. Frank Husband); pheasant (varieties) from Scampston, Dec. 1918 (presented by W. H. St. Quintin, Esq.); a pair of greenshanks from Inverasdale, Ross-shire (presented by J. H. Dixon, Esq.)

The following specimens have been purchased: great titmouse (pair), Suddaby; greenfinch (variety), Leven; house sparrow (variety), Skirlaugh, 1916; and pairs (from Holderness) of wheatear, whinchat, chiffchaff, blue titmouse, common wren, swallow, chaffinch, brambling, yellow bunting, common swift.

There are still a few gaps to be filled even among the commoner species. The Collections, generally speaking, are in good order. Re-labelling has been done where necessary with great care and very effectively.

FIELD NATURALISTS' SECTION.—Excursions for the season included Clifton Ings, Skipwith Common, Warthill, Holly Carr, Askham Bogs, Crambe Beck, Strensall, Dunnington, Sandburn Woods, Terry's Avenue and Bishopthorpe Palace Gardens.

It is regretted that on two or three of the excursions there was a poor attendance.

The excursion to Bishopthorpe Palace Grounds on Sept. 10th was very well attended, 33 members being present.

The lectures for the Winter Session have been well attended.

CLIMATOLOGICAL STATION, YORK.—THE MUSEUM.

Heights above Ground :—Barometer, 3 feet ; Thermometers, 4 feet ; Rain-gauge, 1 foot.

Air Temperature in Degrees Fahrenheit.				Earth Temperature.		Rainfall.				Weather, No. of Days of.								Bright Sunshine.								
Means of		Min. & Max. Combined.	Absolute Extremes.						At 1 ft.	At 4 ft.	Total.	Max.	Total.	Max. Fall.	Day.	Precipitation.	Precipitation 1 mm or more.	Snow.	Snow lying.	Hail.	Thunderstorm.	Fog.	Gale force 8 or more.	Daily Mean.	Total.	Per Cent.
Max.	Min.		Day.	L. Min.	Day.	L. Max.	Day.	H. Min.																		
°	°	°	°	°	°	°	°	° F	° F	mm.	mm.	ins.	ins.											hr.	hr.	%
Jan.	40.2	33.0	36.6	15	25	13	31	13	40	60	15	2.35	0.60	3	20	13	2	2	0	0	0	1	0	0.61	19	8
Feb.	40.6	31.3	36.0	22	18	10	32	8	43	27	5	1.07	0.21	19	10	8	2	1	0	0	0	2	0	1.14	32	12
Mar.	44.0	32.9	38.5	2	24	29	38	19, 22, 25	39	73	21	2.88	0.82	11	18	10	4	1	1	1	0	0	0	2.55	79	22
April	52.4	38.9	45.7	22	29	27	37	27	51	31	7	1.23	0.26	27	13	10	1	0	2	2	1	0	0	3.63	109	26
May	65.9	46.0	56.0	23, 28	38	20	48	8	54	23	7	0.91	0.27	1	13	6	0	0	3	2	1	0	0	7.06	219	45
June	67.3	49.5	58.4	7	42	26	57	26	58	23	5	0.89	0.18	4	12	8	0	0	0	0	0	0	0	5.50	165	33
July	64.5	49.7	57.1	11	41	30	55	1, 6	54	84	32	3.32	1.26	19	13	10	0	0	0	0	1	0	0	3.42	106	21
Aug.	68.1	51.8	60.0	9, 10	39	31	52	28	61	56	19	2.19	0.73	28	15	10	0	0	0	0	0	0	0	5.48	170	38
Sept.	63.9	46.9	55.4	11	32	28	51	20	62	26	7	1.01	0.27	1	9	8	0	0	0	0	1	1	0	4.17	125	33
Oct.	53.6	38.2	45.9	4, 6	30	15	41	28	46	82	19	3.21	0.75	29	16	13	0	0	1	1	0	7	0	3.42	106	33
Nov.	42.7	33.3	38.0	23	21	16	30	29	51	41	5	1.60	0.21	3	23	19	7	6	1	1	0	4	0	1.20	36	14
Dec.	44.7	35.6	40.2	3	26	26	37	9, 10	40	78	22	3.09	0.85	15	24	15	0	0	1	1	0	4	0	1.13	(35)	16
Totals	47.9	7.1	87.8							604		23.75			186	130	16	10	9	5	20	0		1201		
Means or Extremes	54.0	40.6	47.3																					3.29		27

Latitude 53° 57' N., Longitude 1° 5' W. Gravity Correction + 0.8 mb. Height above Mean Sea Level 56 ft.

1919.	Mean Pressure and Lat. 45° corrected to 32° F.			Temperature.		Humidity.				Amount of Cloud. 0—10.		Number of days of		Wind, No. of Observations referred to a total of 93, 90, 87 or 84 for the month.												
	Station Level.	M.S.L. and corrected for diurnal variation.	Mean. ins.	9 a.m. 9 p.m.		Depression of Wet Bulb.		Vapour Pressure.		Percentage.		9 a.m.	9 p.m.	Clear Sky.	Overcast.	Wind Force 8 and above (4—7)	Calm.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	
				°	°	°	°	mb.	mb.	°	°															
																										9 a.m.
Jan.	1004.4	1006.2	29.625	35.9	36.5	1.2	1.1	6.4	6.6	90	91	7.2	6.5	3	15	0	3	0	7	4	3	12	41	9	6	11
Feb.	1007.5	1009.3	29.553	34.2	35.5	1.2	1.1	5.9	6.3	87	90	7.4	6.6	4	15	0	0	0	15	10	4	17	14	9	6	9
Mar.	1007.4	1009.1	29.712	37.8	37.0	1.9	1.5	6.4	6.4	84	87	7.3	5.1	5	13	0	2	0	29	12	3	9	9	3	9	19
April	1011.8	1013.5	29.848	44.8	44.3	3.2	3.3	7.7	7.4	77	75	7.6	5.1	4	12	0	5	0	16	6	0	3	14	15	18	18
May	1016.7	1018.4	29.992	56.0	54.2	4.7	4.2	10.9	10.5	72	73	4.7	4.4	10	7	0	0	0	9	12	29	18	12	4	6	3
June	1016.5	1018.2	29.987	58.0	56.4	5.6	4.0	11.1	11.7	68	75	6.8	5.2	4	7	0	2	1	17	1	1	6	11	14	18	21
July	1015.1	1016.9	29.946	56.4	55.5	3.9	3.1	11.8	12.0	76	80	7.7	8.0	1	17	0	0	3	45	3	3	1	8	3	12	15
Aug.	1012.5	1014.2	29.870	59.9	58.9	4.7	3.8	12.7	13.0	72	77	6.1	5.1	5	8	0	2	1	5	1	1	4	14	8	51	8
Sept.	1013.0	1014.7	29.884	53.5	54.4	3.0	3.0	11.1	11.5	80	80	5.9	4.4	9	9	0	2	1	12	6	0	3	33	15	12	8
Oct.	1019.8	1021.5	30.083	43.7	44.2	2.2	1.9	8.1	8.4	83	85	5.9	4.9	6	10	0	2	6	22	5	0	1	22	9	8	20
Nov.	1006.5	1008.2	29.692	36.8	37.5	1.4	1.2	6.5	6.8	89	90	7.9	6.2	3	16	0	0	9	29	9	5	3	13	8	7	7
Dec.	1004.1	1005.9	29.621	40.5	39.6	1.8	1.5	7.3	7.2	86	88	7.6	5.2	2	10	0	8	1	6	0	3	33	13	29	8	8
Totals	12135.3	12156.1		557.5	554.0	34.8	29.7	105.9	107.8	964	991	82.1	66.7	56	139	0	26	22	212	69	49	80	224	110	182	147
Year Means	1012.1	1013.0	29.901	46.5	46.2	2.9	2.5	8.8	9.0	80	83	6.8	5.6													

Pressure is expressed in millibars (1000 millibars = 29.531 mercury inches), also in mercury inches.

YORK (MUSEUM) 1919.

Year.	BRIGHT SUNSHINE.			Barometer at Mean Sea Level					
	Daily* Mean. 1919	Per- centage.		Absolute.					
		1919	1918						
				Highest.	Highest.	Date.	Lowest.	Lowest.	Date.
	Hours.	%	%	mb.	ins.		mb.	ins.	
Jan.	0·61	8	16	1038·2	30·654	24th, 9 a.m.	974·2	28·783	4th, 9 a.m.
Feb.	1·14	12	13	1042·3	30·681	9th, 9 a.m.	983·4	28·945	{ 20th, 9 a.m. 22nd, 9 a.m.
Mar.	2·55	22	20	1035·5	30·484	17th, 9 a.m.	983·7	29·045	27th, 9 a.m.
Apr.	3·63	26	26	1041·3	30·652	20th, 9 p.m.	973·6	28·655	14th, 9 p.m.
May	7·06	45	34	1027·7	30·350	26th, 9 p.m.	997·6	29·374	2nd, 9 a.m.
June	5·50	33	35	1032·2	30·391	10th, 9 a.m.	1001·7	29·485	30th, 9 p.m.
July	3·42	21	37	1024·7	30·169	{ 25th, 9 p.m. 26th, 9 a.m. 30th, 9 a.m.	1001·0	29·471	1st, 9 a.m.
Aug.	5·48	38	33	1024·4	30·163	12th, 9 a.m.	986·1	29·029	26th, 9 p.m.
Sept.	4·17	33	31	1032·2	30·389	16th, 9 a.m.	992·5	29·221	22nd, 9 p.m.
Oct.	3·42	33	22	1036·9	30·532	7th, 9 a.m.	995·9	29·322	13th, 9 a.m.
Nov.	1·20	14	13	1032·8	30·410	1st, 9 p.m.	988·5	29·102	25th, 9 pm.
Dec.	1·13	16	7	1025·0	30·168	19th, 9 p.m.	981·0	28·883	31st, 9 a.m.
Year.	3·29	27	27	1042·3	30·681	Feb. 9, 9 a.m.	973·6	28·655	Apr. 14, 9 p.m.

The Barometer readings are expressed in millibars (1000 millibars = 29·531 mercury inches), also in mercury inches.

* For Monthly Totals see Form 3211.

RIVER HEIGHT RECORDS REGISTERED BY THE AUTOMATIC RECORDER
AT THE GUILDHALL, YORK, 1919.

Date.	JANUARY.		FEBRUARY.		MARCH.		APRIL.		MAY.		JUNE.	
	Time.	Above or below S.L.	Time.	Above or below S.L.	Time.	Above or below S.L.	Time.	Above or below S.L.	Time.	Above or below S.L.	Time.	Above or below S.L.
1	1 a.m.	ft. in. above 7	1 a.m.	ft. in. above 1	1 a.m.	ft. in. above 1	1 a.m.	ft. in. above 1	1 a.m.	ft. in. above 0	2 a.m.	ft. in. above 0
2	12 p.m.	8	noon	3	"	2	12 p.m.	0	"	0	noon	below 0
3	noon	8	"	4	12 p.m.	7	"	2	noon	0	"	S.L.
4	1 a.m.	7	"	4	1 a.m.	7	"	1	1 a.m.	0	2 p.m.	above 0
5	2 a.m.	6	"	5	"	4	9 p.m.	2	6 p.m.	1	noon	0
6	12 p.m.	5	"	5	2 a.m.	1	noon	3	1 a.m.	7	"	0
7	2 a.m.	5	"	5	12 p.m.	4	1 a.m.	2	11 p.m.	5	"	0
8	3 p.m.	5	"	5	11 a.m.	3	"	0	1 a.m.	2	"	0
9	12 p.m.	5	"	5	1 a.m.	5	"	1	9 a.m.	1	"	0
10	"	8	"	4	10 p.m.	2	"	2	1 a.m.	10	"	S.L.
11	5 a.m.	8	"	4	9 p.m.	8	"	0	"	0	"	S.L.
12	1 a.m.	6	"	4	1 a.m.	8	12 p.m.	1	"	9	"	S.L.
13	"	3	"	4	noon	8	noon	2	noon	0	1 a.m.	S.L.
14	12 p.m.	4	"	3	1 a.m.	2	"	2	"	6	noon	below 0
15	2 p.m.	7	"	3	"	5	5 p.m.	3	"	0	"	0
16	3 p.m.	6	"	4	"	3	1 a.m.	2	"	5	6 p.m.	4
17	1 a.m.	6	12 p.m.	0	"	2	6 a.m.	0	"	0	"	4
18	"	4	1 a.m.	4	"	2	1 a.m.	1	"	0	12 p.m.	4
19	2 a.m.	3	"	2	6 p.m.	2	"	0	1 a.m.	0	1 a.m.	2
20	12 p.m.	2	12 p.m.	5	12 p.m.	4	"	8	noon	0	"	S.L.
21	"	5	"	4	1 a.m.	4	noon	4	"	2	noon	above 0
22	7 a.m.	6	"	6	"	3	1 a.m.	0	"	0	"	0
23	1 a.m.	4	6 a.m.	5	"	2	noon	2	1 a.m.	0	6 p.m.	0
24	"	3	1 a.m.	5	"	1	"	0	noon	below 0	12 p.m.	S.L.
25	"	2	"	3	"	1	12 p.m.	0	"	0	noon	S.L.
26	12 p.m.	2	"	7	noon	1	"	3	"	0	"	S.L.
27	7 a.m.	2	"	2	"	4	1 a.m.	0	"	0	"	S.L.
28	1 a.m.	2	noon	1	12 p.m.	4	noon	0	12 p.m.	2	"	below 0
29	"	1	1 a.m.	8	9 a.m.	5	12 p.m.	5	noon	0	"	0
30	12 p.m.	1	"	1	1 a.m.	3	12 p.m.	1	"	S.L.	"	S.L.
31	3 a.m.	2	1 a.m.	1	"	1	1 a.m.	2	noon	below 0	12 p.m.	S.L.

RIVER HEIGHT RECORDS.

Date.	JULY.		AUGUST.		SEPTEMBER.		OCTOBER.		NOVEMBER.		DECEMBER.	
	Time.	Above or below S.L.	Time.	Above or below S.L.	Time.	Above or below S.L.	Time.	Above or below S.L.	Time.	Above or below S.L.	Time.	Above or below S.L.
1	12 p.m.	ft. in. above 0	noon	ft. in. above 0	noon	ft. in. above 0	noon	ft. in. above 0	1 a.m.	ft. in. above 6	12 p.m.	ft. in. above 3
2	noon	0	"	S. L.	12 p.m.	1	1 a.m.	0	"	2	5 a.m.	4
3	2 p.m.	0	"	S. L.	noon	11	12 p.m.	0	"	1	1 a.m.	3
4	"	0	"	below 0	1 a.m.	6	1 a.m.	0	12 p.m.	1	7 p.m.	4
5	11 p.m.	1	"	0	"	7	noon	S. L.	noon	2	noon	5
6	1 a.m.	1	"	0	"	6	1 a.m.	S. L.	1 a.m.	2	11 a.m.	4
7	"	0	"	0	"	3	noon	below 0	noon	1	1 a.m.	4
8	noon	0	"	0	"	2	"	0	1 a.m.	1	"	2
9	"	0	"	below 0	noon	2	"	0	"	1	"	1
10	"	0	"	0	"	3	"	0	5 p.m.	1	"	2
11	"	0	"	0	"	3	"	0	2 p.m.	1	"	2
12	"	0	"	0	12 p.m.	0	"	0	1 a.m.	0	12 p.m.	3
13	"	0	"	0	6 a.m.	0	"	0	1 a.m.	0	noon	3
14	"	0	"	below 0	12 p.m.	9	"	0	"	0	1 a.m.	2
15	"	0	10 p.m.	1	"	4	4 a.m.	0	noon	0	"	2
16	"	0	2 a.m.	6	1 a.m.	3	12 p.m.	S. L.	"	0	"	1
17	"	S. L.	noon	0	"	4	noon	S. L.	"	0	"	6
18	"	S. L.	"	above 0	noon	3	"	below 0	12 p.m.	0	3 a.m.	6
19	"	S. L.	3 p.m.	below 0	"	3	"	0	"	8	1 a.m.	3
20	"	S. L.	6 p.m.	7	"	4	"	0	1 a.m.	8	12 p.m.	2
21	"	above 0	12 p.m.	S. L.	"	3	"	0	12 p.m.	4	3 a.m.	2
22	"	0	noon	S. L.	"	3	6 a.m.	0	1 a.m.	4	12 p.m.	3
23	"	0	5 p.m.	above 0	"	3	noon	0	"	2	noon	4
24	"	0	noon	S. L.	5 p.m.	5	"	0	12 p.m.	1	2 p.m.	3
25	"	0	"	above 0	noon	2	"	0	"	3	12 p.m.	3
26	1 a.m.	0	6 p.m.	above 0	12 p.m.	11	12 p.m.	above 0	1 a.m.	3	"	6
27	"	S. L.	12 p.m.	0	10 a.m.	2	"	1	"	2	12 p.m.	5
28	noon	below 0	noon	0	1 a.m.	1	12 p.m.	0	2 p.m.	2	noon	7
29	"	0	1 a.m.	0	"	6	"	0	1 a.m.	2	12 p.m.	6
30	"	0	12 p.m.	1	"	4	"	0	"	2	8 a.m.	7
31	"	0	1 a.m.	1	noon	2	"	7	"	1	12 p.m.	6
		0	"	0	9 a.m.	8		4				10

THE TREASURER'S ACCOUNT WITH THE YORKSHIRE

Last Year.	Dr.	INCOME.						£	s.	d.	£	s.	d.
	<i>Subscriptions:</i>												
	Town Members	...	...	...	...	...	681	0	0				
	Country Members	...	...	...	...	...	13	0	0				
	Temporary Members	...	...	...	...	...	1	10	0				
	Lady Subscribers	...	...	...	...	...	89	0	0				
	Associates	...	...	...	...	...	29	0	0				
	Arrears received	...	...	...	...	...	51	15	0				
873	Keys of Gates	...	...	...	...	...	78	5	0				
											943	10	0
	<i>Rents:</i>												
	St. Mary's Lodge	...	...	...	...	...	65	0	0				
	Marygate Baths	...	...	...	...	...	40	0	0				
	Shop, No. 10 Bootham	...	...	...	...	...	25	15	0				
	York Waterworks Co.—Shed	...	...	...	...	...	15	0	0				
	Do. Light	...	...	...	...	...	0	1	0				
	Corporation of York, Lease of Exhibition Land	...	...	...	...	...	2	0	0				
	Post Office—Wayleaves	...	...	...	...	...	1	2	0				
	York Diocesan Training College, Boat Yard	...	...	...	...	...	5	0	0				
189	Letting of Rooms for Lectures and Meetings	...	...	...	...	...	107	9	0				
											261	7	0
	<i>The late Dr. Tempest Anderson's Bequest:</i>												
	Interest on £8,000 New Zealand 4 % Inscribed Stock	...	...	...	...	...	224	0	0				
	„ on £3,200 Great Eastern Railway 4 % Pref- erence Stock	...	...	...	...	...	89	12	0				
	„ on £5,000 North Eastern Railway 4 % Pref- erence Stock	...	...	...	...	...	140	0	0				
	„ on £8,000 Canada 4 % Stock	...	...	...	...	...	224	0	0				
	„ on £3,219 3s. 5d. Bank of England Stock	...	...	...	...	...	225	6	10				
	„ on £5,777 2s. 6d. South Indian Railway 4 % Registered Debenture Stock	...	...	...	...	...	161	15	2				
	„ on £3,368 8s. 5 % War Loan Stock	...	...	...	...	...	168	8	4				
	„ on £2,000 6 % Exchequer Bonds, 1920	...	...	...	...	...	120	0	0				
	Rents of Shops and Dwelling-houses, Nos. 32 and 34 Bootham	...	...	...	...	...	60	0	0				
1455	Income Tax recovered for 3 years	...	...	...	...	...	1170	10	10				
											2583	13	2
	<i>Memo: The above items are shown less tax, if deducted</i>												
	Whitsuntide Admission Fees	...	...	...	...	...	25	18	9				
	Less: Attendants	...	...	...	...	...	5	6	0				
	Fixing and removing barriers	...	...	...	...	...	7	19	7				
13											12	13	2
3	Sale of Reports and Plans	...	...	...	...	...	...	...	...		5	9	9
9	Bank Interest on Current Account	...	...	...	...	...	...	...	...		25	8	0
164	Gate Money	...	...	...	...	...	...	...	...		269	4	3
	Interest on £918 8s. 9d. India 3 % Stock	...	...	...	...	...	...	...	...				
19	(the late Mr. Rawdon's Bequest)	...	...	...	...	...	19	6	0				
5	Grant from Corporation of York towards Meteorological Department	...	...	...	...	...	5	0	0				
25/-	Acknowledgments for Keys of Bowling Green Lockers (for yr. 1918)	...	...	...	...	...	1	4	0				
3	Interest on £100 5 % War Loan Stock	...	...	...	...	...	5	0	0				
											£4131	15	4
	Balance in hands of the Treasurer, 31st December, 1919	...	...	...	...	...					980	15	1
											£980	15	1
	EDWIN GRAY, <i>Hon. Treasurer.</i>												
	Audited and found correct,												
	PHILIP L. NEWMAN.												
	6th February, 1920.												

PHILOSOPHICAL SOCIETY FOR THE YEAR ENDING 31ST DEC., 1919.

Last Year.	EXPENDITURE.							Cr.		
								£	s.	d.
	Crown Rent	...	...	...	...	...	...	1	0	0
	Corporation Rent	...	...	...	...	...	...	14	15	0
	<i>Rates and Taxes:</i>									
	Property Tax and City Rates	...	...	...	...	...	109	8	4	
	Waterworks Company's Rate	...	...	...	...	...	6	2	6	
	Gardeners' Licenses	...	...	...	...	...	3	0	0	
	Receipt and Cheque Books Stamping	...	...	...	...	...	4	0	11	
115								122	11	9
	<i>Insurance:</i>									
	Fire Premiums	...	...	...	...	...	13	11	0	
	Employers' Liability Premiums	...	...	...	...	...	5	9	7	
	National Health Insurance Contributions	...	...	...	...	...	7	2	3	
32								26	2	10
7	Telephone Rent and Calls	...	...	...	...	...		7	18	5
	<i>Salaries and Wages:</i>									
	Museums	...	...	...	...	...	1001	0	6	
1448	Lodge and Gardens	...	...	...	...	...	578	3	0	
								1579	3	6
	<i>General Additions, Repairs, and Expenses:</i>									
	MUSEUMS—									
	Painting and the like	...	...	...	...	50	4	0		
	Joiners', Cabinetmakers', & Plumbers' and Glaziers' Work	...	...	...	...	48	1	3		
	Taxidermy Work & Purchase of Birds	...	...	...	...	17	18	6		
	Antiquities, Coins, Pottery, & the like	...	...	...	...	620	7	6		
	Other Additions, Repairs, & Expenses	...	...	...	...	57	16	11		
98								794	8	2
	ESTATE—									
11	General repairs	...	...	...	...			106	8	6
	GARDENS—									
	Asphalting	...	...	...	...	112	1	6		
	General Additions, Repairs, & Expenses	...	...	...	...	115	9	7		
120								227	11	1
								1128	7	9
37	Library—Books and Binding	...	...	...	...	...	...	44	5	5
78	Lectures	...	...	...	...	...	...	95	19	1
26	Printing and Stationery	...	...	...	...	...	...	19	16	10
8	Printing Communications to Members and Postage of same	...	...	...	...	...	...	6	4	5
46	Printing Reports and Postage thereof	...	...	...	...	...	...	459	12	6
	<i>Gas, Coal, Coke, and Electricity:</i>									
11	Gas	...	...	...	...	...	...	13	6	9
141	Coal, Coke and Cartage	...	...	...	...	...	...	205	13	0
14	Electricity	...	...	...	...	...	...	16	19	7
								235	19	4
6	Sundry Postages	...	...	...	...	...	...	6	19	5
6/-	Sundries	...	...	...	...	...	...	0	3	8
								3748	19	11
	Excess of Income over Expenditure	...	...	...	...	...	...	382	15	5
								£4131	15	4
	Balance in hands of the Treasurer, 31st December, 1918	...	...	...	...	...	...	597	19	8
	Excess of Income over Expenditure, 1919	...	...	...	...	...	...	382	15	5
								£980	15	1

THE TREASURER'S ACCOUNT IN CONNECTION WITH THE FUND FOUNDED BY THE LATE
WM. REED, ESQ., FOR SPECIFIC PURPOSES.

Dr.	INCOME.	£ s. d.	EXPENDITURE	Cr. £ s. d.
Interest on York Corporation 3 % Redeemable Stock, less tax	...	12 12 0	Purchase of Books	... 22 7 3
Interest on £50 on Deposit with the London Joint City and Midland Bank Ltd.	...	1 5 0		
Bank Interest on Current Account	...	2 0 0		
		15 17 0		
Excess of Expenditure over Income	...	6 10 3		
		£22 7 3		
				£22 7 3

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BALANCE SHEET.	£ s. d.
Amount of Fund on 31st December, 1919	711 13 9
Amount invested in York Corporation 3 % Redeemable Stock	600 0 0
Amount placed on Deposit with the London Joint City and Midland Bank Ltd.	50 0 0
Balance in Bank	61 13 9
	£711 13 9

EDWIN GRAY, *Hon. Treasurer.*

Audited and found correct,
 PHILIP L. NEWMAN.
 6th February, 1920.

NEW MEMBERS, &c., ELECTED 1918.

Anderson, C. J., 5 Bootham
 Atkinson, A. E., 46 St. Olave's Road
 Badgley, Capt. J. W., St. Wilfrid's, Clifton
 Baker, Thos., 20 Markham Crescent
 Barton, G. Oswald, 1 Queen Anne's Road
 Bilton, W. A., King's Square
 Birks, W. Cyril, 9 Grosvenor Terrace
 Bowness, W., 32 Charles Street
 Brown, W. Percy, Century House, Davygate
 Carr, Percy, 19 Stonegate
 Chadwick, Rev. John, St. Wilfrid's Rectory
 Cockshott, Maj. A. M., 612 M.T.Co., R.A.S.C., Hull Rd.
 Cutter, William, St. Sampson's Square
 Dent, Charles, 3 Feversham Terrace
 Dobson, Percy, Hillside, Acomb Green
 Dyson, Wells, 7 Davygate
 Gaunt, Arthur, 25 High Petergate
 George, Frederic, 2 Bean Street, Marygate
 Glaisby, Mrs., 11 Portland Street
 Hall, R. P., Station Hotel
 Hawkins, W. B., 16 Sycamore Terrace
 Henderson, Ernest A., 1 North View, Fountayne Street
 Inglis, Ald. J. B., Coney Street
 Jones, J. P., 7 Queen Anne's Road
 Kirton, Edgar, 37 Shipton Street
 Lancaster, Mrs. M., 54 Gillygate
 Leake, Hy., 182 Burton Lane
 Linfoot, A., 35 Goodramgate
 Master, Lt.-Col. A. G., 3 St. Oswald's Road, Fulford
 Merchant, L., Yorkshire Insurance Co.
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DONATIONS TO MUSEUM AND LIBRARY.

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ANTIQUITIES.

- An old Oil Painting taken from St. Mary's, showing Scarbro' Bridge, etc. } Mr. G. Benson.
- Five Photos of Platters, and a Potter's Wheel. } Mr. Frank Green.
- A miscellaneous series of antiquities, including Ladies' Work Cases. } Mr. J. R. Clark Hall.
- A Roman Drinking Vessel found at Clementhorpe, York, 1919, 10ft. deep. } Mr. C. Martin.
- A leaden Leeds Tobacco Jar. Lord Bolton.
- Three One Guinea Notes, North Lincolnshire Bank, November 1809. } Mr. J. Backhouse.
- A Sixpence of James II. found at Fulford. } Mr. Gothard.
- Stone Bust of Buddha. Mrs. M. E. Booth.
- Bronze Ankle Shackle found on the Tang Hall estate. } Mr. Treasure.
- A broken Medieval Jug found in Peter Lane, York. } Messrs. Brown Bros.
- Staff of the Parish Constable of S. Crux, York. } Mr. Parkes.
- A Bronze Spur found at Holgate, York. Anonymous.

CERAMICS.

- Pottery Toothbrush Dish with view in York on cover. } Mr. Hawkswell.
- Six Vases, three Mugs, and one large dish of Delft Ware. } Mr. A. Hurst.

GEOLOGY AND MINERALOGY.

- A small series of Fossil Shells from Kelsey Hill, near Hull, and another series from Wexford, Ireland (Pleistocene), and Head of Halecopsis from the Red Crag. } Mr. A. Bell.

A series of thirty-seven species of Fossil
Shells from the Waltonian Crag (Red
Crag), of Little Oakley. } Mr. F. W. Harmer.

A fine Collection of Minerals, principally
from the Cumberland mines. } Mr. C. E. Elmhirst.

ZOOLOGY.

Varieties of Pheasant, male and female,
shot near Killington, Dec., 1918. } Mr. W. H. St. Quintin.

A pair of Greenshanks from Inverasdale,
Ross-shire, shot by C. E. Elmhirst, } Mr. J. H. Dixon, Pit-
1880. } lochry, N.B.

A Golden Eagle shot in Scotland, and
a Bohemian Pheasant and Partridge
(variety) in case, killed at Berwick-
on-Tweed. } Major P. J. Waldron,
East Hough, Pit-
lochry, N.B.

A Sparrow Hawk and a variety of
Common Pheasant in cases. } Dr. Frank Husband.

Two Pike in case, weights 30 and 25
lbs. } Mrs. Powell.

Four Big Game Heads, a Rammer,
Cleaner and Gun Loader. } Mr. W. Cooper.

Head of Hippopotamus and a small
case of Plaster Casts. } Major Miles J.
Stapylton.

Sepia of Cuttle Fish and specimens of
Teredo in wood from West Africa. } Mr. S. H. Smith.

A cabinet and Collection of British
Lepidoptera. } Miss Wright.

A series of recent Shells from Chili, etc. Lord Bolton.





THE
MALE FLOWER OR MICROSTROBILUS
OF
GINKGOANTHUS PHILLIPSII.

BY

THOMAS JOHNSON, D.Sc., F.L.S.,

Professor of Botany in the Royal College of Science for Ireland, Dublin.

(Communicated by Rev. W. JOHNSON, B.Sc.)

DURING a visit to the York Museum in 1917 to see the fine collection of fossil plants there, more especially those of *Ginkgo* affinities, my attention was called by Mr. W. Watson to a specimen (*Fig. 1*) labelled "Female cone of *Ginkgo digitata*." The fossil had already been examined several times, and variously labelled. The original (now in part obscure) label runs: "Unknown leaves... pl. 7, fig. 23 in 'Illustrations.'" On the underside of the slab are two added labels, one stating the object is probably the male flower* of *G. digitata*, the other and earlier label that it is formed of small fruits borne three together on the short branches of a spike. My brother, the Rev. W. Johnson, the Hon. Curator of the Geological Collection, allowed me to make a further examination of the fossil. It consists of a central axis, here and there recognisable, bearing spirally arranged short stalks carrying at their free ends three flattened oblong bodies, 5 mm. long, 1.5 to 2 mm. broad, marked by several longitudinal striae, and showing

*In 1880 Nathorst published an account of a visit he paid to the collections of fossil plants in the Museums in Britain. He specially mentions this York fossil (*op. cit.* pp. 74—78) and says of it: "He had already seen in the York Museum an indistinct agglomeration of these 'unknown leaves,' and suspected they were male flowers of some *Ginkgo*, a view fully supported by a remarkable specimen in the Leckenby Collection in Cambridge. I am indebted to Miss L. Stephens, M.A., for a translation of this account.

in some cases signs of a longitudinal slit. The whole fossil is 35 mm. long, and 14 mm. wide. The striate oval bodies are in threes and highly suggestive of the arrangement of the ovules in *Baiera Münsteriana* (pl. 3, fig. 9, in Renault's "Cours," tome 4), and yet at the same time they are suggestive of the arrangement of the stamens in the male flower of *Ginkgo biloba* (Fig. 4). It is not surprising that this fossil impression should have been described from a surface examination by one authority as a female spike, and by another as probably a male flower of *Ginkgo digitata*. The specimen was originally in the Bean Collection which was divided into three sets, one set being given to the British Museum, another to Mr. Leckenby who presented his set to the University of Cambridge, the third set coming to the Yorkshire Philosophical Society, now housed in the Yorkshire Philosophical Society's Museum. I mention this mode of distribution of the Bean Collection in explanation of apparent discrepancies to be found in publications giving references to specimens of the Bean Collection. The York Museum specimen is clearly labelled, (by Phillips?) "Unknown leaves, pl. 7, fig. 23,¹ in 'Illustrations,' " and yet Seward² in vol. iv. (just published) of his valuable work on "Fossil Plants" gives on p. 52, fig. 654B, a drawing of a specimen in the Sedgwick Museum, Cambridge, as the representative of these same "unknown leaves" of pl. 7, fig. 23. It is possible that both specimens carry the same reference to the one figure which is made to do duty by Phillips for all the specimens of the same kind he found in the Bean Collection. The figure by Phillips shows the tips of three narrow elliptical leaves, each with a single median vein, and in both editions of his work (that published in 1829 and the revised edition of 1875 by R. Etheridge), it is described as that of "unknown leaves." Seward, writing on these specimens (op. cit. iv. p. 51), says:—"Unfortunately it has not been possible to make any preparations of the cuticularised remains showing microspores and while the probability is that the oblong bodies are microsporangia it is not impossible that they are small seeds." I have been more fortunate in the examination of the York material and have got results that prove, I think conclusively, we have before us the male flower of a fossil *Ginkgo*.

One of the oblong bodies was removed, treated with Schulze's macerating mixture, and examined microscopically. Several grains were isolated and found to be (Figs. 7 and 8) microspores or pollen-grains. They are oval bodies in one aspect, trilateral or

triangular in another, and strikingly like the microspores of the primitive *Cycas*—*Dioon edule*—as figured by Chamberlain (fig. 155, p. 141). The triradiate mark shown (Fig. 8) is the well-known indication of a tetrahedral mode of origin of microspores. Their shape is also very similar to that of a microspore or pollen-grain of *Pinus* or *Abies* when deprived of its air-sacs. Though so much has been written on the interesting genus *Ginkgo*, it is difficult to find a description or illustration of its pollen-grain or microspore. There is a figure in the "Morphology of Gymnosperms" by Coulter and Chamberlain (p. 207, fig. 236) showing a germinating pollen-grain as a spherical body. It is quite different in appearance from our fossil microspore which has a more Cycadean appearance. Examination of herbarium material of restored *Ginkgo* microspores (Fig. 7) shows the grain to differ in form according to the aspect viewed. It is a flattened oval in one view and sub-triangular in another, averaging 33 by 27 μ in diameter, that of the fossil microspore being 28 to 31 μ in width. There is not that marked discrepancy in form the first inspection of the fossil spore suggested. Its shape does, however, tend to emphasise the tendency of an approximation of the *Ginkgoales* and *Cycadales* to a common ancestry.

Further evidence that the specimen before us is a *male flower* is provided by examination of the spore-case or pollen-sac. Not only is the longitudinal slit, indicative of the same mode of dehiscence as in *Ginkgo*, recognisable under the microscope, but the apparently undulating or folded surface of the cell-walls of the cells forming the wall of the spore-case or microsporangium (Fig. 6) due to the fibrous thickening of the cell-walls, so well seen in the wall of the pollen-sac of a recent *Ginkgo* (Fig. 5) is clearly recognisable. Such fibrous bands or thickenings are a common feature in the mechanism of opening in the walls of the pollen-sac or microsporangium in all the higher groups of plants, and are not to be found in ovules or seeds. The evidence is convincing that the "unknown leaves" are in reality part of the male flower or microstrobilus of a *Ginkgoites*. The exact nearness of affinity of the fossil plant bearing this type of male flower to the modern *Ginkgo biloba* is a matter for discussion. The wedge-shaped, usually bilobed, leaves of the maiden-hair tree, *Ginkgo biloba* (*Salisburia adiantifolia*), with their forking veins and double leaf-trace system are highly characteristic. Leaves of this type are traceable far back in fossil strata, and in the Yorkshire Jurassic beds

near Scarborough are apparently plentiful. The older the bed the greater the lobation of the leaf, one kind of leaf on account of its markedly narrow and deep lobes being the well-known *Ginkgo digitata*. It is not improbable that the male strobilus under consideration is that of this *Ginkgo digitata* which is recorded from the same beds and is represented by detached leaves in the York Museum.

The male flower or strobilus of *Ginkgo biloba* (Fig. 4) consists of a short axis carrying numerous horizontally and spirally arranged stamens. Each stamen consists of a filament carrying at its free end pendulous pollen-sacs or microsporangia which split lengthwise. The distal end of the filament is not necessarily, as often described, a mere knob but may be distinctly peltate and the number of pollen-sacs borne on it given generally as two, may be three, a number quoted by Heer³ and Leuthardt.⁶ Heer states, under his description of *Ginkgo sibirica*, that the stamens of *Ginkgo biloba* he examined carried three, more frequently than two, pollen-sacs. In her account of the stamen of *Ginkgo* Miss Anna M. Starr⁴ describes the development of the mucilage ducts in the distal end of the stamen and suggests that their origin may indicate the derivation of the stamen of *Ginkgo* from a peltate type like that of *Taxus*. This is highly suggestive of the epaulette or *Crossotheca*⁵ type of stamen of the *Cycadofilices*.

Leuthardt describes the much divided foliage and more complex male flowers of *Baiera furcata* Heer from the Keuper of Bâle and calls attention to their essential likeness to those of *Ginkgo*. Many of the stamens in this fossil appear as short horizontal filaments carrying at their distal ends three or four pollen-sacs. Leuthardt compares them to a three- or four-pronged fish fork. Seward notes these in his account of the male flower of the *Ginkgoales* but does not mention a more interesting type to which Leuthardt calls attention (op. cit. fig. 2, Taf. 11). He was fortunate enough, he says, to find a filament 3 mm. long, arising from the axis of the flower expanding fan-like outwards and carrying on its surface (really according to the figure radiating from its edge) four secondary filaments each bearing three pollen-sacs. This multifid plurisporangiate stamen shows a degree of branching comparable to that of the much segmented foliage leaf of *Baiera furcata* to which species Leuthardt assigns his male flower. The relation of this type to Nathorst's *Antholithus Zeilleri* from Rhaetic beds is evident.

The increase in number of the pollen-sacs or microsporangia borne by the filament in the fossil *Ginkgoales* in the older deposits would be in keeping with the known increase of lobation of the leaves in such deposits. The Ginkgoaceous type of foliage is preceded by that of the genus *Baiera* with its narrow and numerous leaf segments. Though the leaves of members of the *Ginkgoales* become more and more segmented as we pass downwards from the Tertiary through the Mesozoic to the Permian where the group appears to be represented by the filamentous *Trichopitys heteromorpha* we have in the Upper Devonian of Kiltorcan in Co. Kilkenny in *Kiltorkensia devonica*¹⁰ a type of foliage which suggests a combination in the one leaf of the wedge-shaped type of leaf of a *Ginkgo* with that of a *Trichopitys*, thus indicating the possibility of a primitive parent stock from which two lines have diverged—one persisting to the present time in *Ginkgo*, the other line represented by *Trichopitys* having died out in the early Mesozoic.

Until specimens showing actual continuity between the foliage shoot of a *Ginkgo* and its supposed male flowers are found in the fossil state, we cannot definitely refer the male flowers to *Ginkgo*, spite of the evidence of close affinity and their juxtaposition in the same beds. It is better to place such fossil male flowers either in the provisional genus *Antholithus*, a term first used by Linnæus according to Nathorst (who has revived it), to include all such specimens or, as I prefer, in a case like this where the *Ginkgo* affinity is pretty clearly marked, to use Nathorst's more indicative term *Ginkgoanthus* (printed *Ginkganthus* in the work⁹ quoted) and call the York Museum specimen *Ginkgoanthus Phillipsii*—(male flower or *microstrobilus* of).

An examination by the maceration method would probably reveal other interesting specimens in the Collections of the Museum.

October, 1919.

ILLUSTRATIONS.

- Fig.* 1. Drawing of male flower or microstrobilus of *Ginkgoanthus Phillipsii*, Sp. n., x 2. By Miss Barnes.
2. Photograph of same male flower, x 3. (Reversed in Plate).
3. Group of three pollen-sacs or microsporangia, x 12.
4. Microstrobilus or male flower of *Ginkgo biloba* (restored).
5. Wall of pollen-sac of *G. biloba*, showing the fibrous cell-walls.
6. Piece of wall of pollen-sac of *Ginkgoanthus* showing longitudinal slit of dehiscence and also fibrous marking of cell-walls.
7. Pollen-grains or microspores of *G. biloba* (restored).
8. Isolated pollen-grain or microspore of *Ginkgoanthus* showing triradiate mark.
9. Photograph, by Mr. W. Watson, of foliage of *Ginkgo digitata*, from specimen in York Museum.

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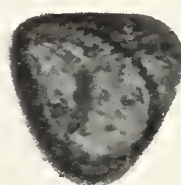
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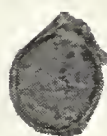
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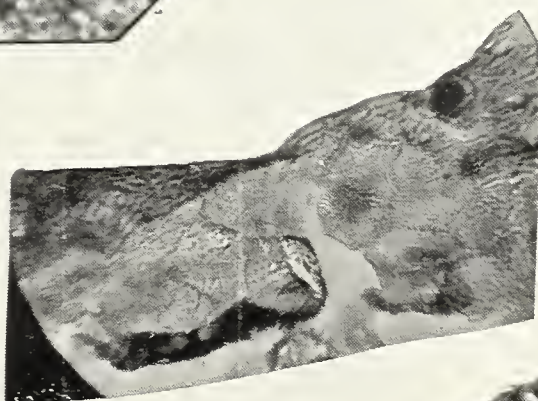
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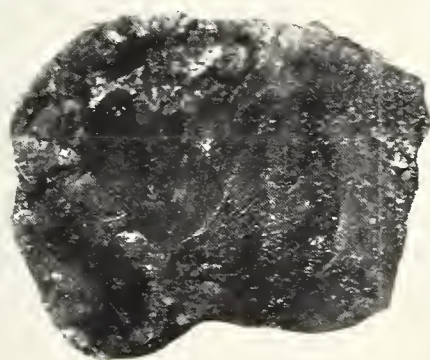
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BRITISH FISHES AND REPTILES— PLIOCENE TO HOLOCENE.

BY ALFRED BELL.

NOTE. A number of the species quoted below are certainly older than the deposits they occur in, but owing to the uncertainty as to their range in time have been included with a suggestion as to their probable geological horizon. Where these are invested in their original matrix of London Clay, this can be easily determined, but where occurring free of this (like many of the Sharks and Rays do), as isolated teeth or bones it is not so clear, "because the genera and species indicated by these fragments are closely similar to those surviving in existing seas."¹ Mr. E. T. Newton also says² that "specimens of *Lamna elegans* and *L. contortidens* in the Mus. Pract. Geol. are beautifully perfect, and these it is thought must be of Red Crag Age," and of *Otodus obliquus* "many of these seem to be too perfect to have been derived from Eocene strata, although there is no doubt as to their belonging to the London Clay species." The same may be said of *Phyllodus*, *Myliobatis* and other genera and species represented in the York Museum.

Contractions—Cor. Cr. (Coralline Crag). Red Cr. (Red Crag). Icen. (Icenian).
Weyb. (Weybourne beds). Crom. (Cromerian). Pleist. (Pleistocene).
K.m. (Kitchen middens). Hol. (Holocene).

* Species so marked are represented in the Museum of the
Philosophical Society, York.

Acanthias vulgaris, Risso. (Piked dog). *Weyb.* E. Runton; *Pleist.*
Grays, Essex; *K.m.* Colonsay and Oransay, W. Scotland.

Squatina sp. *Red. Cr.* Little Bealings, Suffolk.

Squatina angelus, Dumeril. (Angel fish). *K.m.* Cnoc Sligeach,
Oransay.

¹ A. S. Woodward. *Proc. Geol. Assoc.* XII. p. 1.

² *Pliocene Vertebrata*. Mem. Geol. Survey, Gt. Britain.

**Pristis bisulcatus*? Agassiz. (Sawfish). *Red. Cr.* Suffolk (rostral teeth). *Eocene*.

**Raja batis*, Montagu. (Grey Skate). *Cor. Cr.* Gedgrave; *Weyb.* E. Runton; *Pleist.* Bridlington; *K.m.* Colonsay, Oransay, Hastings.

**Raja clavata*, Linné, (*antiqua* Ag.) (Thornback). *Cor. Cr.* Gedgrave, Orford; *Red. Cr.* passim; *Icen.* Thorpe, Easton Bavent, Yarn Hill; *Weyb.* E. Runton; *Pleist.* Chillesford; *K.m.* Oransay, Hastings.

Raja n. sp. figured but not named by Mr. E. T. Newton, *Plioc. Vert.* p. 21, pl. ix. Other dermal spines are recorded from the *Cor. Cr.* Gedgrave, Boyton; *Pleist.* Tenby, Banff, and Carrick-a-rede, Co. Antrim, and probably belong to one or other of the above species.

Myliobatis Dixoni, Agassiz. *Cor. Cr.* Boyton; *Red. Cr.* Newbournian Zone.

**Myliobatis striatus*, Buckland, and **M. toliapicus*, Agassiz, are obtained in fine preservation, with all the dental plates in position, from the Middle *Red. Cr.* (Newbournian Zone) Suffolk. The above three species are in very fine condition, and may have lived on from the Eocene seas. *Pl. II. fig. 13.*

Myliobatis tumidens, A. S. Woodward. *Red. Cr.* Near Woodbridge.

Waterworn plates of the Eagle Ray group are common in the Red Crag. Those recorded from Bridlington in Mr. Headley's Collection are too far gone for determination.

**Aetobatis irregularis*, Agassiz. *Red Cr.* Sutton, Waldringfield. ? *Eocene*.

**Rhinoptera* (*Zygobatis*) *Woodwardi*, Agassiz, Common in the *Red Cr.* and the *Icen.* Bramerton and Thorpe.

Ptychodus decurrens, Ag., *P. mammilaris*, Ag., and *P. polygyrus*, Ag. Teeth of these Cretaceous species are occasionally met with in the *Red Cr.* of the Deben Valley, and *P. latissimus* is recorded in the *B. M. Cat. Fossil Fishes* from Orford, Suffolk.

**Strophodus magnus*, Agassiz. A detached tooth of this Gt. Oolite species is preserved in the York Museum, probably brought into the Red Crag era by floating ice from the Lincolnshire Jurassic series.

Trygon, sp. *Cor. Cr.* Gedgrave. Mr. E. T. Newton (op. cit.) refers to two fish-defences suggesting that they may belong to some species of Trygon which he had not been successful in identifying with them.

*Notidanus gigas, Sismonda. *Cor. Cr.* (Boytonian Zone) near Orford; *Red Cr.* Bealings, Felixstow, Newbourn, Butley (E.T.N.). Figured in the *Rep. Yorks. Phil. Soc.* 1886, pl. i., fig. 4. The York specimen has been also figured by Dr. A. S. Woodward in the *Geological Magazine*, 1866, woodcut p. 255. *Pl. I. fig. 1.*

*Notidanus menegheni, Lawley = N. gigas, A.S.W. *Red Cr.* Waldringfield. Figured by Mr. Platnauer as above, pl. 1, fig. 5, and by Dr. A. S. Woodward, *Geol. Mag.* 1886, woodcut, fig. 2, p. 256. *Pl. I. fig. 2.*

*Notidanus primigenius, Agassiz. *Cor. Cr.* Boyton; *Red Cr.* Newbournian Zone, E. Suffolk. Figured by Dr. A. S. Woodward as above, pl. vi. fig. 22 (Reed Collection). *Pl. I. fig. 3.*

Notidanus n. sp.? A nearly complete tooth, bearing 8 cusps, obtained from the Upper Coralline Crag at Boyton in the Butley Marshes, Suffolk, is in the Mus. Pract. Geol., London, and as the cuspid details are quite unlike any of those figured by Dr. A. S. Woodward, op. cit., I have reproduced it here (pl. fig. 4) for comparison with the fine examples in the Reed Collection. The specimen measures 24 mm. in length. By the cuspid arrangement the fossil seems to agree with the figure of N. griseus, Cuv., given by F. Bassani (*R. As. Sc., Napoli*, 1901). *Pl. I. fig. 4.*

Notidanus sp. The fragments of teeth from Bridlington in the Headley Collection referred by Mr. E. T. Newton (*Q. J. G's.*, vol. 40, 1884, p. 323) to N. microdon, a cretaceous species, and by Dr. A. S. Woodward to N. serratissimus, Ag., an eocene form, show no trace of derivation, and occurring with Arctic shells and other forms may possibly represent a living Arctic fish. A lower symphysial tooth of probably the same species (A. S. W.) was found with them. The genus is recorded from the Icenian Crag of Thorpe, near Norwich. *Pl. I. figs. 5, 6, 7.*

Ginglymostomus sp. *Red Cr.* Little Bealings (Moor Collection).

Odontaspis (*Lamna*) *cornubica*, Gmelin. (Porbeagle). *Red Cr.* Butley; *Pleist.* Selsey.

[Note.—Teeth of *Odontaspis* Sharks occur in profusion in the older beds of the Red Crag, but are not so common in the newer horizons, nor in the preceding Coralline Crag. They have been referred to many species including *Lamna Rutoti*, *L. contortidens*, *L. cuspidata*, *L. elegans*, *L. Hopei*?, *L. verticalis*, *L. vincenti*, and others. They are frequently much worn and rolled, but specimens with sharp points and cutting edges are not rare. Some small teeth of this group occur in the Bridlington deposits,¹ but if these are, as suggested, of Eocene origin, it is difficult to see how they got associated with the varied Arctic fauna all of living types. *Odontaspis macrotus*, Agassiz, has been obtained from the Red Crag beds at Foxhall and Ipswich.]

Oxyrhina crassa, Agassiz. *Red Cr.* Hemley Hall. "Specimen quite unabraded and has not the appearance of a derived fossil." (*A. S. W. Geol. Mag.*, 1894, p. 75) also at Little Oakley.

**Oxyrhinus hastalis*, Agassiz (including *O. plicatilis*, and *O. trigonodon*, quoted by S. V. Wood, *Q. J. G. S.*, vol. xv.). *Box-stones*, Suffolk; *Cor. Cr.* Gedgrave, Orford; *Red Cr.* Very common in the Waltonian and Newbournian Zones.

**Oxyrhina xiphodon*, Agassiz. *Cor. Cr.* Gedgrave; *Red Cr.* Suffolk. A fine example with very thin and sharp cutting edges is in the Reed Collection, York.

Otodus trigonalis, Jaeckels. *Red Cr.* The Dales, N. Ipswich, probably elsewhere.

**Otodus Obliquus*, Agassiz. *Box-stones*, Suffolk, and common in the earlier zones of the Red Crag. It appears to be an Eocene species that has lived on into the Pliocene. I do not know it from the Coralline Crag.

**Carcharodon auriculatus*, Blainville = *C. angustidens*, Agassiz. *Red Cr.* Older Zones, often in good condition. The York example from Waldringfield exhibits the serrated edges well displayed, and is a very fine specimen. *Pl. I. fig. 8.*

**Carcharodon megalodon*, Agassiz. *Box-stones*, Suffolk. Coralline and Red Crag. Very common in the Red Crag of all dimensions.

¹ See "Fossils of the Basement Clay of Holderness." *Naturalist*.
(York), 1915—19.

**Carcharodon Rondeletii*, Müller et Henle = *C. sulcidens*, Agassiz. (Great Blue Shark). *Cor. Cr.* Orford; *Red Cr.* Waldringfield, Sutton, etc., the teeth often exhibiting serrated edges. A worn fragment from Bridlington may be assigned to this wide-spread species, but is too far gone for definite determination.

**Cetorhinus maximus*, Linné. (Basking Shark). *Red Cr.* Waldringfield.

Cetorhinus dupontii, Hasse. *Box-stones*, Suffolk. Vertebrae corresponding to those of the Rupelian Shark are not uncommon.

Galeocerdo aduncas, Agassiz. The late S. V. Wood in his paper on "The extraneous fossils of the Red Crag" (*Qt. Jour. Geol. Soc.*, vol. xv. 1859) records this species. It is not mentioned by Dr. A. S. Woodward in the *B. M. Cat. of Fossil Fishes* as a British species, nor in his "Notes on the teeth of Sharks and Rays" (*Proc. Geol. Assoc.*, vol. xvi., 1899). I have had the genus from the Red Crag of Walton.

**Galeus canis*, Bonaparte. (Tope). *Plioc.* St. Erth, Cornwall; *Weyb.* E. Runton; *Pleist.* Selsey; *K.m.* Oransay.

Galeus sp. *Red Cr.* Little Bealings, Walton Naze.

Ischyodus sp. *Red Cr.* Suffolk. (Mandibular teeth).

**Edaphodon Bucklandi*, Agassiz. *Red Cr.* Suffolk. (Eocene). *Pl. I. fig. 9.*

Edaphodon leptognathus, Agassiz. *Red Cr.* Woodbridge. (Eocene).

**Elasmodus Hunteri*, Egerton. *Red Cr.* Waldringfield. (Eocene). *Pl. II. fig. 4.*

**Coelorhynchus rectus*, Agassiz. *Red Cr.* Suffolk. (Eocene).

Acipenser latirostris, Parnell. (Broad-nosed Sturgeon). *Crom.* Mundesley; *Pleist.* Stonehouse Point, Devon.

Acipenser sturio, Linné. (Sturgeon). *Red Cr.* (York Mus.); *Icen.* Bramerton; *Weyb.* E. Runton; *Crom.* Mundesley, Sidestrand.

**Acipenser* sp. *Cor. Cr.* Gedgrve; *Red Cr.* Waldringfield. A very perfect scute is in the Reed Collection from the Coralline Crag.

**Acipenser* sp. Dr. A. S. Woodward (op. cit. vol. xi., p. 29) has referred some pectoral spines from the Red Crag in the Reed

Collection to an unnamed species of Sturgeon, and has also kindly examined for me the photo. of a fine bony plate belonging to the Mus. Pr. Geology, London, labelled *Acipenser* Sp., Red Crag. This, he says "no doubt represents a dermal scute of *A. toliapicus*, Ag.," an Eocene species. It is of good size, ovate, 80 mm. long, 50 mm. broad at its widest diam. Saddle shaped above, coarsely reticulate, with raised pittings in a smooth surface except at the widest end where it is unbroken. Under surface nearly flat, tilling up at the narrowest point.

- (?) *Reedii*, n. sp. Bony plates of a fish having close affinities to the above have been obtained from the Coralline Crag, Orford, and the Red Crag, Waldringfield, several of these being in the York Museum. In shape they are a long oval, rising to a rounded ridge in the middle, bluntly pointed at one end, and broadly depressed at the other. Saddle shaped above, smoothly concave below. The sculpture consists of irregularly rounded pits placed in regular order giving an appearance of coarse reticulation, strongest on the medial ridge. Length 50 mm., breadth 30 mm., depth 15—20 mm. The genus is very doubtful, but being unnamed, I have called the bones after my old friend, Dr. Reed. *Pl. I. fig. 10.*

The beautifully marked scute, *pl. I. fig. 11*, apparently belongs to another genus or species at present undescribed.

- **Sphaerodus* sp. Some large and isolated teeth with round crowns are occasionally present in the Red Crag. Mr. Newton remarks "that some of these round teeth are similar to those of *Sphaerodus cinctus*, Agassiz." The larger ones are not unlike *S. gigas*, Agassiz.

- **Pycnodus toliapicus*, Agassiz. This well marked Eocene species is represented in the Reed Collection by one of the finest specimens known, exhibiting the dentition in beautiful preservation. *Pl. II. fig. 16.* (Red Crag, Suffolk).

Gyrodus, *Albula*, (*Pisodus*) and *Lepidotus* are in the list of fishes from the Crag, given by Mr. E. T. Newton in "The Pliocene deposits of Britain," p. 235 (*Mus. Geol. Survey*, 1890). They occur mostly as isolated teeth, derived from pre-crag sources. *Lepidotus* scales have been obtained from the Red Crag of Walton-on-the-Naze.

- **Brychaetus Muelleri*, A. S. Woodward (ex Agassiz). *Red Cr.* Suffolk. (Eocene). A very fine example is in the York Museum.

**Halecopsis insignis*, Delvaux and Ortlieb. (Eocene). *Red Cr.* Suffolk. The squamation of this Eocene fish is generally well exhibited in the derived examples. It is of common occurrence in the Red Crag. *Pl. II. fig. 15.*

Clupea harengus, Linné. (Herring). *Hol.* (Roman) Silchester.

Clupea (Alosa) finta, Cuvier. (Twaite Shad). *Hol.* (Celtic) Glastonbury.

Salmo salar, Linné. (Salmon). *Pleist.* Mundesley (Arctic bed), perhaps *S. trutta*, E.T.N.

Salmo trutta, Linné. (Trout). *Hol.* (Celtic) Glastonbury.

Salmo trutta fario. (Irish lake Trout). *Hol.* or late *Pleist.* Kesh Cave, Co. Sligo.

Cyprinus carpio, Linné. (Carp). *Hol.* or late *Pleist.* Kesh Cave. *Hol.* (Roman) Silchester.

Barbus vulgaris, Fleming. (Barbel). *Weyb.* W. Runton.

Gobio fluviatilis, Willoughby. (Gudgeon). *Hol.* (Roman) Silchester.

Leuciscus cephalus, Linné. (Chub). *Crom.* Ostend ; *Pleist.* Swanscombe and Grays in the Thames Valley.

Leuciscus eryophthalmus, Linné. (Rudd). *Icen.* Aldeby ; *Weyb.* W. Runton ; *Pleist.* Swanscombe, Grays, Hoxne, Hitchin.

Leuciscus rutilus, Linné. (Roach). *Icen.* Aldeby ; *Weyb.* W. Runton ; *Crom.* Mundesley ; *Pleist.* Swanscombe, Grays, Ilford, all in the Thames Valley, Hoxne, Hitchin ; *Hol.* (Celtic) Glastonbury, (Roman) Bermondsey, London.

Leuciscus dobulus, Linné. (Dace). *Pletst.* Swanscombe, Grays.

Tinca vulgaris, Cuvier. (Tench). *Weyb.* W. Runton ; *Pleist.* Swanscombe, Grays, S. Elmham, Hoxne, Hitchin.

Abramis brama, Linné. (Bream). *Weyb.* W. Runton.

Arius Egertoni, Dixon. (Sheat, or Catfish). *Red Cr.* Foxhall. (Eocene).

Anguilla vulgaris, Turton. (Eel). *Pleist.* W. Wittering, Sussex, Swanscombe, Grays ; *Hol.* (Roman) London, Silchester, Eden-vale Cave, Co. Clare, (? recent).

Conger niger, Risso. (Conger). *Neolithic* or *Azilian*. *K.m.* Oransay, Ardrossan.

Belonostomus? sp. *Pleist.* Bridlington. Mr. E. T. Newton in a MS. note says of two pointed needle-like teeth in the Headley Collection: "resembling those of *Belonostomus*."

Esox lucius, Linné. (Pike). Very widely distributed in the *Icenian* Aldeby Crag; *Crom.* W. Runton, Pakefield, Kessingland; (*Sub-Arctic*) Beeston, and Ostend, Norfolk; *Pleist.* W. Wittering, Clacton, Swanscombe and the Thames Valley from Grays to Crayford, S. Elmham, Hitchin; *Hol.* Hornsea, Withernsea, and Sand-le-Mere, Holderness, the Fenlands generally, Copford, and Windsor.

Gasterosteus aculeatus, Bloch. (Stickleback). *Hol.* (Roman) Silchester.

Mugil capito, Cuvier. (Grey Mullet). *Hol.* (Roman) Silchester.

The Mullet is recorded from the shell heaps of Colonsay and Dunagoil Cave, W. Scotland. The latter has been referred to *M. chelo* or *M. cephalus*.

Ammodytes sp. (Sand Launce). *Pleist.* Crayford in the Thames Valley.

[The Gadoids are mostly represented by their Otoliths. The syllable "pre" is often added by Continental writers to the specific name where the fossils agree with those of existing species. (Col. Shepherd on "Fossil Otoliths," *Knowledge*, xxxix. 1916).

Gadus aeglifinus, Linné. (Haddock). *Pleist.* Selsey, Bridlington; *K.m.* Banff, Oransay; *Hol.* Portrush, Co. Antrim.

Gadus pseudoaeglifinus, E. T. Newton. *Cor. Cr.* Sutton, Sudbourne, Boyton; *Red Cr.* Walton Naze, Little Oakley, Weybourne.

Gadus (*Phycis*) *elegans*, Koken. *Plioc.* St. Erth; *Cor. Cr.* Sutton, Walton Naze; *Pleist.* Selsey.

Gadus merlangus, Linné. (Whiting). *Plioc.* St. Erth; *Red. Cr.* Walton Naze; *K.m.* Hastings.

Gadus (*Morrhua*) *luscus*,¹ Linné. (Whiting Pout). *Cor. Cr.* Sutton, Broom Hill, Boyton; *Pleist.* Selsey. (Cl. Reid).

¹ Koken's species (*Gadidarium*) *anglicus*, var. *corallinensis* figured in *Knowledge*, vol. xxxix., fig. 157 (3) p. 182, seems to be the same as this, or to be closely allied to it.

Gadus (*Morrhua*) *morrhua*, Linné = *vulgaris*, Cuvier. (Cod).
Cor. Cr. Sutton; *Red Cr.* Shottisham, Butley; *Icen.* Bramerton;
Weyb. Trimingham; *Pleist.* Sewerby Bridge, Bridlington, Mundesley, Kelsey Hill; *K.m.* Hastings, Ardrossan, Dunagoil, Banff, Caithness; *Hol.* (Roman) Barton near Cambridge, Edenvale and Ballintroy Caves, and Whitepark Bay, Ireland.

Gadus (*Morrhua*) *minutus*, Linné. (Power Cod). *Cor. Cr.* Sutton;
Red Cr. Little Oakley; *Icen.* Bramerton; *Pleist.* Bridlington.

Gadus (*Merlangus*) *pollachius*, Fleming. (Pollack). *Cor. Cr.* Sutton; *Red Cr.* Butley; *Icen.* Bramerton; *Weyb.* E. Runton; *Hol.* Portrush, Co. Antrim.

Gadus (*Merlangus*) *virens*, Linné. (Coalfish). *Cor. Cr.* Sutton;
Pleist. Oban Cave.

Gadus (*Merlucius*) *vulgaris*, Fleming. (Hake). *Cor. Cr.* Sutton;
Red Cr. Oakley; *K.m.* Richmond, Yorkshire.

Gadus (*Merlucius*) *vulgaris*, var. *Suffolkensis*, Koken. *Cor. Cr.* Sutton.

Lota molva, Cuvier. (Ling). *K.m.* Banff.

**Tetrapterus priscus*, Agassiz. *Red Cr.* Suffolk, in Newbournian Zone. (Eocene).

Perca fluviatilis, Linné. (Perch). *Icen.* Aldeby; *Crom.* Kessingland, W. Runton, and elsewhere in the Norfolk Cliffs; (*Sub-Arctic*), Beeston, Happisburgh, Mundesley, Ostend; *Pleist.* Swanscombe, Hitchin, Hoxne, S. Elmham; *Hol.* Hornsea, Holmpton, and Withernsea in Holderness, (Celtic) Glastonbury, (Roman) Silchester.

Acerina cernua, Linné. (Ruffe). *Crom.* W. Runton; *Pleist.* Swanscombe, Grays.

Smaris vulgaris, Cuvier. *Pleist.* Selsey (Otolith).

Pagellus centrodontus, Cuvier. (Sea Bream). Azilian, Cnoc Sligeach, Oransay, Gobbins Cave, Co. Antrim. *Hol.* (Roman) Silchester.

Pagellus sp. Selsey (Mus. Pract. Geol. London).

Cantharus lineatus, Montagu. (Black Sea Bream). Azilian, Shell heaps, Oransay.

**Chrysophrys* sp. near *C. aurata*, Cuvier. (? Gilt Head) *Cor. Cr.* Gedgrave, Boyton; *Red Cr.* Isolated teeth very common; *Icen.* Bramerton; *Weyb.* E. Runton; *Pleist.* Bridlington. These teeth have been sometimes referred to *C. Hennahii*, but the reference is not very satisfactory. Groups of rounded and pointed teeth, and many loose examples are common in the Crag, some are tentatively assigned to *Chrysophrys*, others to the Wolf fish, *Anarrhicas lupus*. *Pl. II. fig. 12.*

Labrus maculatus, Bloch. (Ballan Wrasse). *Azilian, K.m.* Oransay, Colonsay, Ardrossan, Oban; *Hol.* Edenvale Cave, Co. Waterford.

Labrus sp. (Wrasse). *Cor. Cr.* and *Red Cr.* Felixstow.

**Platax Woodwardi*, Agassiz. (Allied to Horse Mackerel). *Cor. Cr.* Orford; *Red Cr.* Common; *Icen.* Thorpe, Easton Bavents, N. Walsham, Southwold, Yarn Hill; *Weyb.* Trimingham, Weybourne, W. Runton; *Crom.* Norfolk Cliffs; *Pleist.* Chillesford, Bridlington.

Mr. E. T. Newton ("Pliocene Vertebrata," p. 90) has some remarks upon these difficult bones, whose affinities are not yet satisfactorily worked out. The species is "only known by detached bones, most of which are thickened by hyperostosis."

Thynnus thynnus, Linné. (Tunny). *Crom.* E. Runton, Hasborough.

Thynnus Scaldisi, Storms. *Cor. Cr.* Aldborough, Orford.

Scomber scombrus, Linné. (Mackerel). *K.m.* Hastings.

**Scombrinus (Cybium) macropomus*, Agassiz. *Cor. Cr.* Sutton: *Red Cr.* Waldringfield, Felixstow, etc., fine fragments are not uncommon (Eocene).

[Dr. A. S. Woodward refers (*A. and M. Nat. Hist.* (6) vol. 5, p. 294, 1890) to some Scombroïd vertebrae in the B. M. Collection from the Red Crag that may represent some early tertiary species at present undetermined.]

**Phyllodus toliapicus*, Agassiz. Pharyngeal plates of this species, and of **P. polyodus*, Agassiz; *P. hexagonalis*, Cocchi; *P. speciosus*, Cocchi; and *P. submedius*, Cocchi, all occur in the Red Crag Newbournian Zone in very fine condition with the crushing teeth in their natural position, quite unworn. The genus is only known by its dentition, and may have lived on from the Eocene Seas to those of the middle Pliocene. *Pl. II. fig. 17.*

**Egertonia isodonta*, Cocchi. *Red Cr.* Suffolk. (Eocene).

Hippoglossus vulgaris, Fleming. (Halibut). *Pleist.* In gravel with palaeolithic implements, Dovercourt near Harwich, (Underwood Coll., Ipswich Mus.) Four others were found near Woodbridge.

Rhombus (*Psetta*) *maximus*, Linné. (Turbot). *K.m.* Hastings.

Pleuronectes (*Platessa*) *vulgaris*, Cuvier. (Plaice). *K.m.* Hastings.
Some fossils recorded from the Cromerian of Overstrand, Norfolk, may belong to this group.

Solea vulgaris, Cuvier. (Sole). *K.m.* Hastings.

Gobius premaculatus, Shepherd M. S. (Sea Gudgeon). *Plioc.* St. Erth.

Cottus sp. *K.m.* Hastings. The spinal column of a fish from the *Cor. Cr.* of Sudbourne, in the Mus. Pract. Geol., seems according to Mr. E. T. Newton ("Pliocene Vertebrata,") to suggest an affinity with such a form as *Cottus scorpius*, or one of the Weevers.

Trigla sp. (Gurnard). *K.m.* Hastings.

**Anarrhicas lupus*, Linné. (Wolf fish). *Cor. Cr.* Gedgrave, Boyton; *Red Cr.* Walton Naze, Waldringfield, and probably elsewhere; *Hol.* Carrick-a-Rede, Co. Antrim. The teeth are often confused with those of *Chrysophrys*.

Amongst the Otoliths from Selsey referred to in the *Report of the Yorks. Phil. Soc.*, 1892, p. 60, as of uncertain origin, probably Eocene, are some that have been assigned to *Cottus*, *Cepola*, *Apogonarium*, and *Berycidarum parvulus*, Koken.

REPTILIA.

Crocodylia sp. *Red Cr.* Scutes. (Eocene).

Lacerta vivipara, Jaquin. (Sand Lizard). *Pleist.* Bone Caves, Carnforth, Ightham.

Anguis fragilis, Linné. (Blind Worm). *Pleist.* Bone Caves, Carnforth, Ightham. *Hol.* (Roman) Caerwent.

Molge cristata, Laur. (Crested Newt). *Crom.* W. Runton. *Pleist.* Ightham fissure.

Tropidonotus natrix, Linné. (Grass Snake). *Crom.* Bacton, W. Runton. *Pleist.* Swanscombe, Grays, Ightham and Langwith Caves, Grimes Graves.

Vipera berus, Linné. (Viper). *Crom.* W. Runton; *Pleist.* Ightham.

Emys orbicularis, Linné. *Pleist.* Mundesley river bed, Ulrome in Holderness.

(*Emys Europea* is said to have been common in the fens in prehistoric times. Marr and Shipley, *Nat. Hist. Cambridge*, p. 107).

Emys pleistocenus, Abbott. *Pleist.* Whitehall (London). Sp. Swanscombe.

The *Chelonia* of the London Clay are represented in the Red Crag by the skulls, bones, and portions of the carapace and plastron of *Argillochelys convexa*, *Lytoloma breviceps*, *L. longiceps*, *L. planimentum*, and other species.

Bufo vulgaris, L. (Toad). *Crom.* W. Runton; *Pleist.* Grays, and in Carnforth, Ightham, Langwith, and Longcliffe Caves, Grimes Graves, Norfolk; *Hol.* (Roman) London, Caerwent, Silchester.

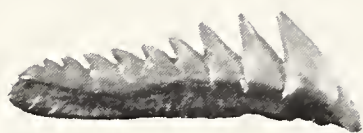
Rana esculenta, L. (Edible Frog). *Crom.* W. Runton; *Pleist.* Ightham; *Hol.* (Roman) Silchester.

Rana temporaria, L. (Common Frog). *Crom.* W. Runton, Side-strand; *Pleist.* Swanscombe, Grays, and at Carnforth, Ightham, Langwith, Longcliffe and Wye Caves; *K.m.* St. Catherine's, Isle of Wight, Assynt and Dunagoil Caves, W. Scotland; *Intercalated in till*, Carham-on-Tweed; *Hol.* Edenvale, Kesh and Newhall Caves, Ireland.

I have to thank Dr. A. S. Woodward for his kindly assistance and advice, and Mr. W. Watson for the beautiful photographs used in illustration of this paper.



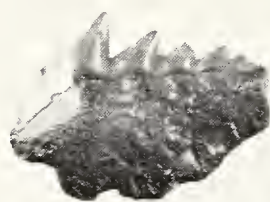
PLATE I.



I



2



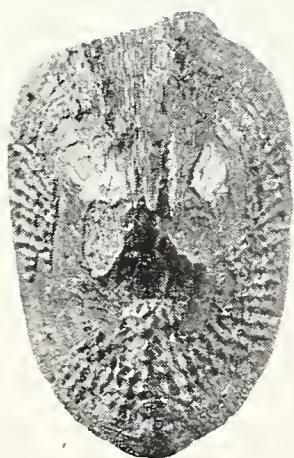
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4



9



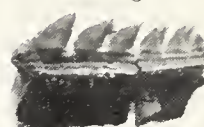
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5



6



7



8



11

PLATE I.

Fig.

1	Notidanus gigas.	Red Crag.	Suffolk, York Museum.
2	„ meneghenii.	„	„ „
3	„ primigemus.	„	„ „
4	„ griseus?	Coralline Crag.	Boyton M.P.G.
5	„ symphysial tooth.	Pleistocene.	Bridlington, Headley Coll.
6	„ sp.	„	„ „
7	„ sp.	„	„ „
8	Carcharodon augustidens.	Coralline Crag.	Orford, York Museum.
9	Edaphodon Bucklandi.	Red Crag.	derived „
10	(?) Reedii.	„	Suffolk „
11	„ „ (scute).	„	„ „

[The above figures are about two-thirds the size of the original specimens.]

PLATE II.

Fig.

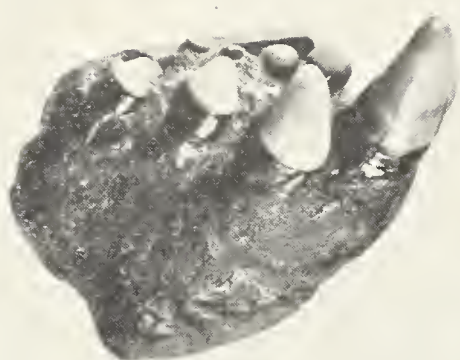
12	<i>Chrysophyrys</i> , sp.	Red Crag.	Suffolk, York Museum.
13	<i>Myliobatis toliapicus</i>	„ ? derived.	„ „
14	<i>Elasmodus Hunteri</i> .	„ „	„ „
15	<i>Halecopsis insignis</i> .	„ „	„ „
16	<i>Pycnodus toliapicus</i> .	„ „	„ „
17	<i>Phyllodus polyodus</i> .	„ „	„ „

[The above figures are about two-thirds the size of the original specimens.]

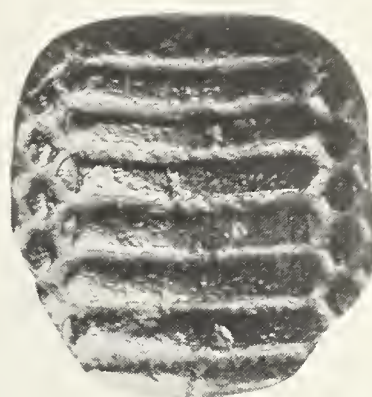
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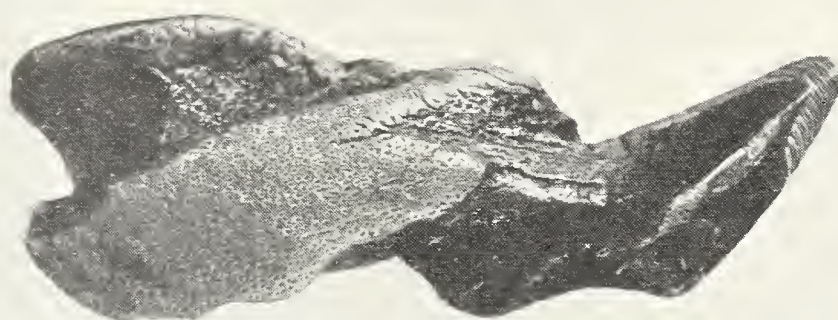




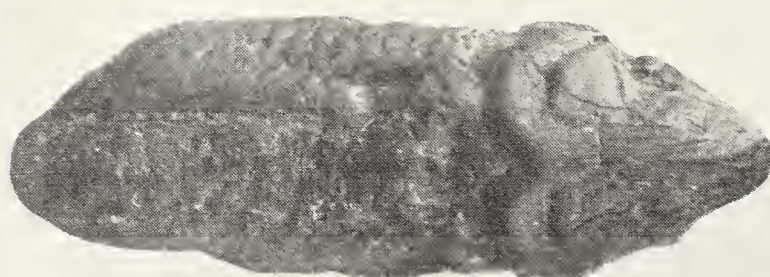
12



13



14



15



16



17



